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AJO PEAK TO TINAJAS ALTAS: A FLORA OF SOUTHWESTERN ARIZONA PART 9. EUDICOTS: CONVOLVULACEAE – MORNING GLORY FAMILY

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ABSTRACT

A floristic account is provided for the morning glory family as part of the vascular plant flora of the contiguous protected areas of Organ Pipe Cactus National Monument, Cabeza Prieta National Wildlife Refuge, and the Tinajas Altas Region in the heart of Sonoran Desert in southwestern Arizona. The family includes 11 species in 4 genera (*Cuscuta, Evolvulus, Ipomoea, Jacquemontia*) in the flora area, all of which are native. This is the ninth contribution for this flora published in Phytoneuron and also posted open access on the website of the University of Arizona Herbarium (ARIZ).

The first part of the Flora of southwestern Arizona flora series includes maps and brief descriptions of the physical, biological, ecological, floristic, and deep history of the flora area (Felger et al. 2013a) and explanations for the format for the species accounts is given in part 3 (Felger et al. 2013b). These contributions are also posted open access on the website of the University of Arizona Herbarium (ARIZ). Vernacular, or common names, when known, or deemed worthwhile, are given in English, Spanish, and the Hia C-ed O'odham dialect, respectively. The one fossil specimen is marked with a dagger symbol (†). Area designations are: OP = Organ Pipe Cactus National

Monument, CP = Cabeza Prieta National Wildlife Refuge, and TA = Tinajas Altas (Figure 1). All specimens cited are at the University of Arizona Herbarium (ARIZ) unless otherwise indicated by the abbreviations for herbaria at Cabeza Prieta National Wildlife Refuge (CAB), Organ Pipe Cactus National Monument (ORPI), and the standardized abbreviations for herbaria (Index Herbariorum, Thiers 2014). All microphotographs of *Cuscuta* are by Mihai Costea and all photos are by Sue Rutman unless otherwise stated. For more images see the galleries provided in the Digital Atlas for the Convolvulaceae of Sonora (Costea & Austin et al. 2012). Descriptions and identification keys pertain to taxa and populations as they occur in the flora area.

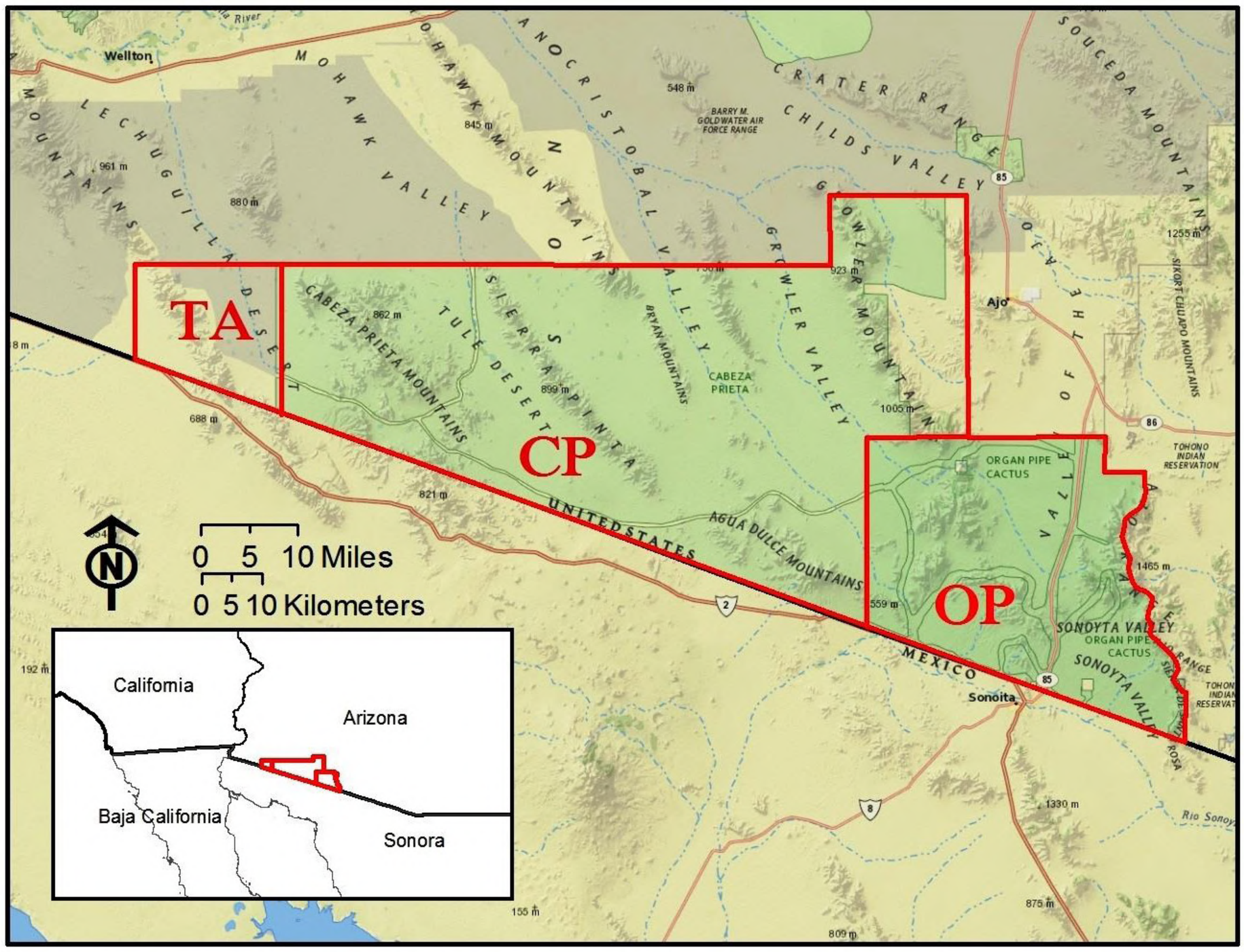

Figure 1. Flora area in southwestern Arizona. Area designations are: OP = Organ Pipe Cactus National Monument, CP = Cabeza Prieta National Wildlife Refuge, and TA = Tinajas Altas. Green shading indicates approximate boundary of federally designated wilderness.

CONVOLVULACEAE – Morning Glory Family

Ephemeral to perennial vines and subshrubs or herbaceous perennials (those in the flora area); or obligate parasites with little or no chlorophyll and vegetative parts much reduced in *Cuscuta*. Leaves alternate, simple, entire to deeply parted, and without stipules. Flowers radial, 5-merous (those in the flora area), and often showy. Calyx persistent. Corollas sympetalous, those in flora area (except *Cuscuta*) with the parts folded within the bud (plicae) being glabrous, whereas those parts exposed in the bud (interplicae) form a star-shaped pattern in the expanded corolla and are often pubescent. Fruits of dry capsules; seeds 1–4 (6).

The Convolvulaceae constitute a diverse cosmopolitan assemblage of 58 genera and an estimated 1880 species (Staples 2014). This monophyletic family has greatest diversity in tropical and subtropical regions worldwide and does not generally occur in higher latitudes, and diversity also

decreases with aridity. Detailed information for the convolvs of Arizona and Sonora is provided by Austin (1998), Costea, Austin, et al. (2012), Costea, Felger, et al. (2012), and Felger and Austin, et al. (2012). Eleven species in four genera occur in the flora area of southwestern Arizona (Table 1). All occur in Organ Pipe, three extend into Cabeza Prieta, and none range into the hyperarid Tinajas Altas Region.

Taxon	**Region**			**Growth Form**		
	Organ Pipe	Cabeza Prieta	Tinajas Altas	Ephemeral		Perennial
				Summer	Winter	
CONVOLVULACEAE						
Cuscuta californica var. *californica*	OP			SU		
Cuscuta legitima	OP	CP		SU		
Cuscuta salina	OP			SU		
Cuscuta tuberculata	OP			SU		
Cuscuta umbellata var. *umbellata*	OP	CP		SU		
Evolvulus alsinoides	OP					PR
Ipomoea barbatisepala	OP			SU		
Ipomoea costellata	OP			SU		
Ipomoea cristulata	OP			SU		
Ipomoea hederacea	OP	CP		SU		
†*Ipomoea* sp.	(OP)					
Jacquemontia pringlei	OP					PR
Totals	**11**	**3**	**0**	**9**	**0**	**2**

Table 1. Local distributions and growth forms of Convolvulaceae for the flora in southwestern Arizona. † = Fossil taxon. OP = Organ Pipe Cactus National Monument, CP = Cabeza Prieta National Wildlife Refuge, TA = Tinajas Altas Region.

1. Parasitic twining ephemerals without chlorophyll; stems appearing leafless (leaves reduced to scales) and orange; flowers 5 mm or less in length or width and white..... **Cuscuta**
1. Plants green, not parasitic; stems leafy and not orange; flowers 1 cm or more in width or length and not white (except *Jacquemontia*).

2. Stems not vining; leaves entire, mostly less than 1 cm wide, sessile or very short petioled ..... **Evolvulus**
2. Stems vining; leaves entire or lobed, more than 1 cm wide and petioled.

3. Ephemeral vines; leaves entire, lobed, or divided; corollas various colors but not white; stigmas lobes globose (the stigma is a 2-lobed sphere); pollen grains spiny (visible with a dissecting microscope)..... **Ipomoea**
3. Perennial subshrubs with twining upper stems; leaves entire; corollas white, becoming pale lavender-pink as the flower ages during the day; stigma lobes oblong; pollen grains smooth ..... **Jacquemontia**

Cuscuta – Dodder; *fideo*; vepegĭ vasai

Parasitic twining ephemerals with orange stems, leaves reduced to minute, alternate scales, and small white flowers that become creamy when dried (those in the flora). Flowers 5-merous (those in the flora area; some are 4-merous elsewhere). Growing with warm weather, especially during late spring and the summer rainy season. All the species in the flora area are members of subg. *Grammica* (Costea et al. 2015; García et al. 2014; Stefanović et al. 2007). The two species with

indehiscent (not circumscissile) capsules, *C. californica* and *C. salina*, belong to sect. *Californicae* (Costea et al. 2015; or "clade A", Stefanović et al. 2007); they have somewhat thicker and more robust stems, and parasitize shrubby perennials or herbaceous plants. The species with dehiscent capsules, *C. legitima*, *C. tuberculata*, and *C. umbellata*, belong to sect. *Umbellatae* (Costea et al. 2015; previously called "clade L", Stefanović et al. 2007); they have thinner and more delicate stems, and grow on annuals (ephemerals) and small perennial herbs.

Cuscuta is nearly cosmopolitan and comprises ca. 200 species (Costea 2007; Costea et al. 2015). The taxonomy of this large and diverse genus is complicated (Costea et al. 2015; Stefanović et al. 2007; Yuncker 1932). As in many holoparasitic plants, a number of organs are reduced or absent, and distinguishing features are often minute and not easily seen. Identification during the vegetative stage is possible only by using molecular markers. The minute appendages in *Cuscuta* flowers called infrastaminal scales are taxonomically useful but require the careful dissection of flowers using a microscope, usually at least 50× power. In the flowers of subg. *Grammica*, these minute structures likely have the role to protect the ovary against insect herbivory (Riviere et al. 2013). When viewed fresh and with good illumination the floral structures including the scales are quite beautiful. Yet even dried flowers can be hydrated, dissected, and the floral characters discerned. Upon drying at maturity, the dehiscent (circumscissile) capsules open in a clean circle around the capsule towards the base, while the indehiscent capsules may break apart or rupture irregularly. For more information and images of the floral morphology, see the galleries provided in the Digital Atlas of *Cuscuta* (Costea 2007). Information about pollen, gynoecium, and breeding systems is available in Welsh et al. (2010) and Wright et al. (2011, 2012).

KEY 1. Capsules not needed

1. Perianth, especially the corolla tube papillate; calyx lobes keeled, ⅓–½ as long as the corolla tube; on ephemerals ..... **Cuscuta tuberculata**
1. Perianth not papillate (in *C. umbellata* and *C. salina* papillae or dome-like cells are present only on corolla lobes); calyx lobes not keeled, ¾ as long as the corolla tube, or equaling to longer than corolla tube; on ephemerals or perennials.

2. Infrastaminal scales absent or reduced to ridges; Ajo Mountains, often on *Calliandra eriophylla* ..... **Cuscuta californica** var. **californica**
2. Infrastaminal scales present, well developed.

3. Infrastaminal scales slightly shorter than the corolla tube, oblong; styles shorter than the ovary; locally on *Suaeda* in SW part of Organ Pipe ..... **Cuscuta salina**
3. Infrastaminal scales equaling or exceeding corolla tube, spatulate to obovate; styles equaling or longer than the ovary; widespread on herbaceous perennials (not on *Suaeda*) and especially on summer ephemerals.

4. Flowers 4–5.5 (6) mm long ..... **Cuscuta legitima**
4. Flowers 2–3 mm long ..... **Cuscuta umbellata** var. **umbellata**

KEY 2. Capsules needed

1. Capsules not circumscissile, sometimes breaking apart irregularly.

2. Capsules ± globose, not narrowed apically or thickened around the interstylar aperture; 2–4 seeds per capsule; known from the Ajo and Santa Rosa Mountains, often on *Calliandra eriophylla* ..... **Cuscuta californica** var. **californica**
2. Capsules ellipsoidal, narrowed apically and thickened around the interstylar aperture; 1 seed per capsule (rarely 2); localized on *Suaeda* at Quitobaquito ..... **Cuscuta salina**

1. Capsules circumscissile, opening in a clean circle around the capsule towards the base.

3. Calyx lobes keeled, ⅓–½ as long as the corolla tube; corolla tube cylindrical; infrastaminal scales conspicuously shorter than the corolla tube, not reaching the filaments ..... **C. tuberculata**
3. Calyx lobes not keeled, as long as, or longer than the corolla tube; corolla tube campanulate; corolla scales reaching the filaments and often slightly protruding from the corolla tube.

4. Flowers 4–5.5 (6) mm long ..... **Cuscuta legitima**
4. Flowers 2–3 mm long ..... **Cuscuta umbellata** var. **umbellata**

Cuscuta californica Hooker & Arnott var. **californica**
California dodder. Figure 2.

Inflorescences loose to dense, paniculate; pedicels 0.5–3.0 mm long. Flowers 5-merous, 3–5 (5.5) mm long, fleshy; papillae absent. Calyx 1.5–2.2 mm long, golden yellow when dried, finely reticulate and shiny, turbinate-campanulate, ¾ to as long as the corolla tube, tube 0.4–0.7 mm long, lobes 0.8–2 mm long, triangular-ovate to lanceolate, overlapping at the base, acute to acuminate. Corolla 3–5 mm long, the tube 1.6–2.4 mm long, cylindric-campanulate to obconic, lobes 2.0–2.6 mm long, narrowly lanceolate, equaling or longer than the corolla tube, initially erect, later reflexed. Infrastaminal scales absent or reduced to ridges. Ovary ovoid to obovoid; styles evenly filiform, 1.2–2.2 mm long, as long or longer than the ovary. Capsules 1.5–2.2 × 1.2–2.5 mm, indehiscent, ± globose, not narrowed apically or thickened around the interstylar aperture, surrounded (not capped) by the withered corolla. Seeds 2–4 per capsule. References: Costea et al. (2006); Costea & Stefanović (2009).

Plants in the flora area are var. *californica* characterized by non-papillate flowers and capsules with 2–4 seeds. Often abundant in the Ajo Mountains where it can turn entire slopes orange in April, and visitors to Organ Pipe Cactus National Monument ask about it every year; also in the Santa Rosa Mountains. Often on *Calliandra eriophylla* but also on a wide range of annuals (ephemerals) and perennials.

Washington to Baja California, southern Nevada, and western Arizona. It is unknown from Sonora but is expected in nearby north-central regions of the state.

OP: Cement Tank [Alamo Canyon], [on *Calliandra eriophylla*, flowers 4.5–5.5 mm, calyx shorter than the corolla tube], 14 Apr 1941, *McDougall 97*. Alamo Canyon, 28 Aug 1943, *Clark 10924* (ORPI). Bull Pasture: 3300 ft, 9 May 1979, *Bowers 1712*; abundant on *Calliandra eriophylla* and many other hosts including *Calochortus*, *Cryptantha*, *Verbena neomexicana*, etc, 9 Apr 2005, *Felger 05-178*.

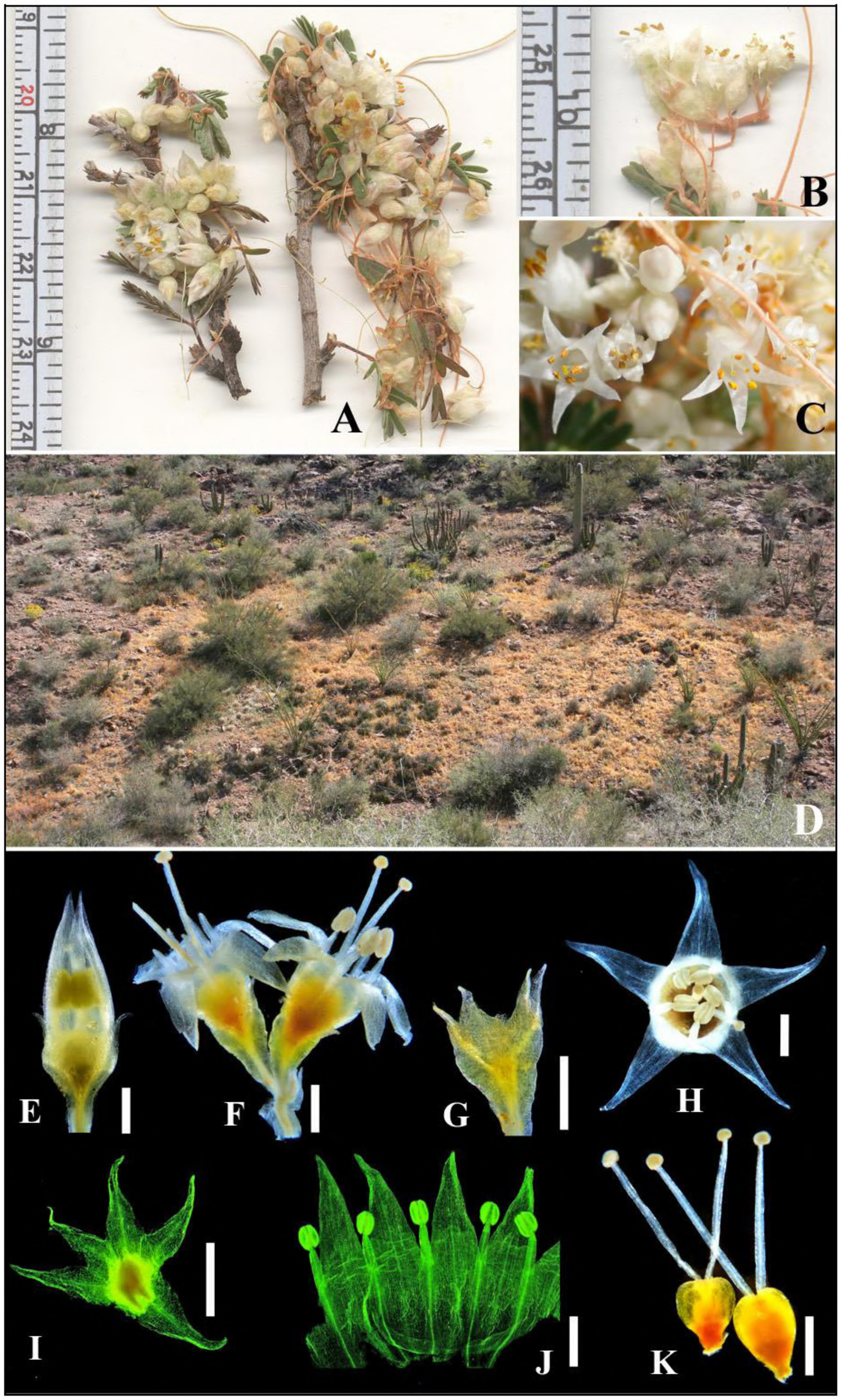

Figure 2. *Cuscuta californica* var. *californica*. Bull Pasture: (A & B) on *Calliandra eriophylla*, 7 Mar 2014; (C) 30 Mar 2008; (D) characteristic expansive local population, 11 May 2010. Flower morphology, scale bars = 1 mm: (E) flower before anthesis; (F) flowers; (G) calyx (not dissected); (H) corolla viewed from the top; (I) dissected calyx; (J) dissected corolla (note the lack of infrastaminal scales); (K) gynoecia.

Cuscuta legitima Costea & Stefanović
[*C. umbellata* var. *reflexa* (J.M. Coulter) Yuncker]
Figure 3.

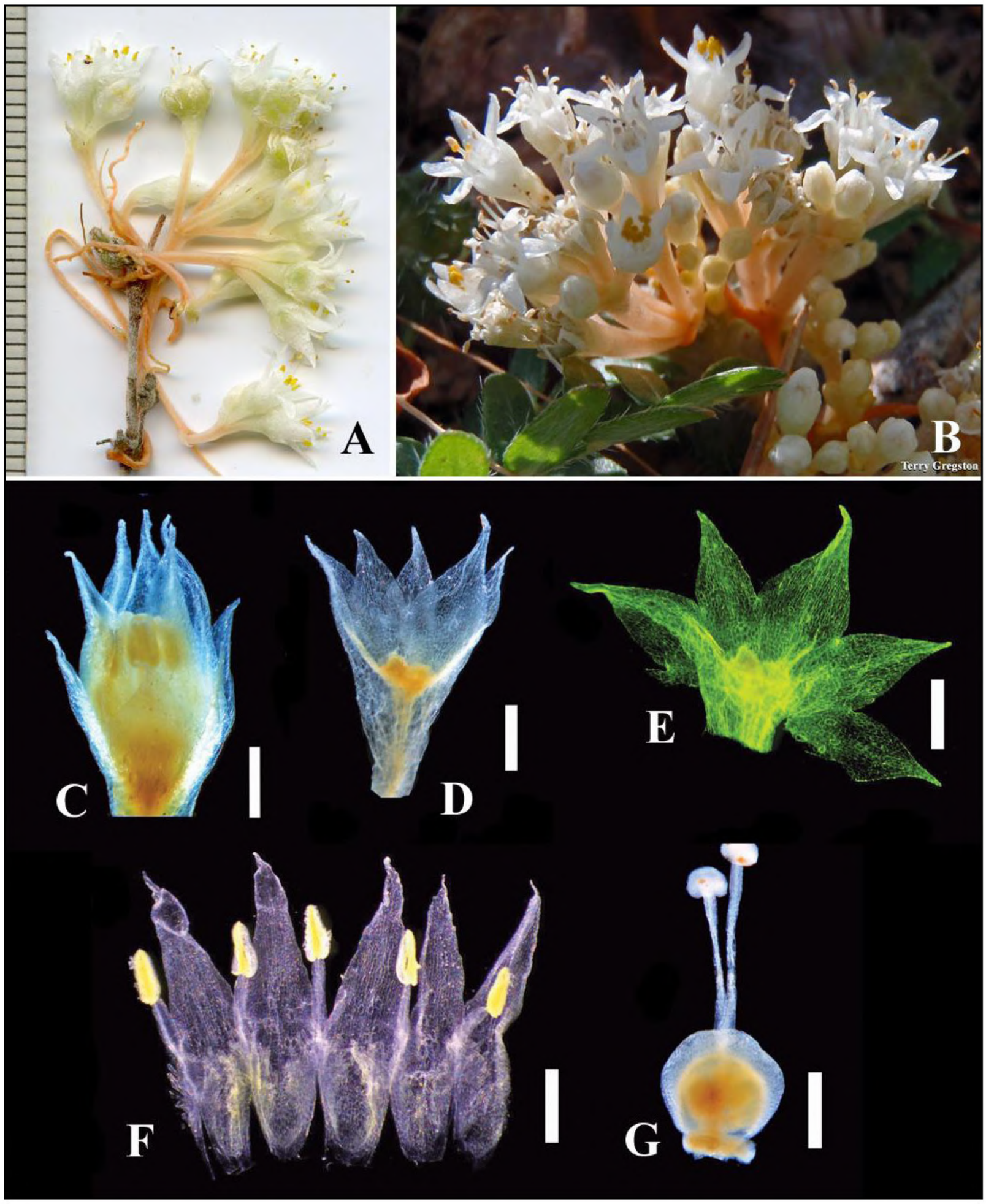

Figure 3. *Cuscuta legitima*. (A) Mex Hwy 8, 35 km S of Sonoyta, 12 Sep 2014. (B) Carlsbad, Eddy Co., NM, 3 Nov 2011, © photo by Terry Gregston (Costea 2007). Flower morphology, scale bars = 1 mm: (C) flower; (D) calyx, not dissected; (E) dissected calyx; (F) dissected corolla; (G) gynoecium.

Inflorescences dense to loose, umbelliform; pedicels 2–10 mm long. Flowers 5-merous, 4–5.5 (6) mm long, membranous; papillae absent. Calyx 2.5–3.2 mm long, straw-yellow, finely reticulate, slightly shiny, campanulate, longer than corolla tube, divided ⅔ the length, the calyx tube 0.6–1 mm long with lobes 1.5–2.2 mm long, not basally overlapping, ovate-lanceolate, not carinate, the apex (calyx lobes) acuminate. Corollas 3.8–5.2 (5.6) mm long, the tube 1.6–2.1 mm long, campanulate, the lobes 1.8–3 mm long, initially erect, later reflexed, longer than the tube, linear-

lanceolate, margins entire, apex acuminate. Infrastaminal scales 1.8–2.2 mm long, equaling or slightly longer than the tube, bridged at 0.2–0.4 mm, spatulate to obovate, fimbriae 0.2–0.5 mm long. Ovary globose; styles 0.9–2.5 mm long, longer than the ovary. Capsules 2–3 × 1–2 mm, circumscissile, depressed, irregularly thickened and slightly elevated around the inconspicuous interstylar aperture, translucent, surrounded or capped by the withered corolla. Seeds 2–4 per capsule.

Cuscuta legitima is a hybrid species and its putative parents are *C. umbellata* var. *umbellata* on the paternal side and *C. odontolepis* (or some other unknown related species) on the maternal side (Costea & Stefanović 2010). This relationship explains the morphological similarity between *C. legitima* and *C. umbellata* var. *umbellata*.

Known from Organ Pipe by a single record and from Cabeza Prieta by two records, but probably more widespread. On herbaceous hosts.

Arizona to Kansas, New Mexico, and Texas, and Mexico in Baja California, Sonora, Chihuahua, Coahuila, and Tamaulipas.

OP: Estes Canyon, in wash, on *Eriogonum deflexum,* 26 Aug 2014, *Rutman 20140826-6.*

CP: 1 mile S of Bates Well Road on road to José Juan Tank at boundary of the Refuge and Organ Pipe, sandy desert plain, on *Boerhavia erecta, B. spicata, Bouteloua aristidoides, B. barbata, Chamaesyce polycarpa, Kallstroemia californica, K. grandiflora, Tidestromia lanuginosa*, 15 Sep 1992, *Felger 92-740* (ARIZ, CAS). Daniels Arroyo at Charlie Bell Road, on on *Kallstroemia* sp. and *Tidestromia lanuginosa*, 24 Aug 2014, *Rutman 20140824-6.*

Cuscuta salina Engelmann

Saltmarsh dodder. Figure 4.

Inflorescences dense, corymbiform; pedicels (0.5) 1–5 mm long. Flowers 5-merous, 2.5–4.5 mm long, fleshy, papillae or dome-like cells present on the corolla lobes. Calyx 1.5–2.5 mm long, glossy yellow, cylindric to narrow campanulate, equaling corolla tube, tube 0.6–1.2 mm long, lobes 0.7–1.5 mm long, ovate-lanceolate to lanceolate, not basally overlapping, acute to acuminate. Corolla 2.2–4.0 mm long, the tube 1.2–2 mm long, cylindric-campanulate to obconical, the lobes 1.3–2 mm long, ovate-lanceolate to oblong-lanceolate, equaling the corolla tube, initially erect, later spreading or reflexed, apex acute to acuminate or cuspidate (sometimes appearing tridentate). Infrastaminal scales 1–1.8 mm long, 80–90% of the corolla tube length, oblong to slightly obovate, bridged at 0.18–0.45 mm, fimbriae 0.03–0.20 mm long. Ovary ellipsoid, the styles 0.4–0.9 mm long, shorter than the ovary. Capsules 1.6–2.5 × 1.7–2.2 mm, indehiscent or irregularly dehiscent, ellipsoid, narrowed at the top and thickened around the small interstylar aperture, surrounded or capped by the withered corolla. Seeds 1 (2) per capsule. References: Costea et al. (2006, 2009).

Reproductive June–December. Localized along the southwest boundary of Organ Pipe from the vicinity of Quitobaquito to Hocker Well and in adjacent Sonora near Sonoyta, growing on *Suaeda nigra* [*S. moquinii*].

Cuscuta salina occurs in Baja California, New Mexico, Texas, Utah, and southern Arizona where the populations apparently are few and widely disjunct and in adjacent northern Sonora. Host plants are *Frankenia, Salsola, Suaeda,* and *Wislizenia*.

OP: Hocker Well, 20 Dec 2001, *Rutman s.n.* (ORPI). Quitobaquito: [on *Suaeda nigra*] 29 Nov 1939, *Harbison 26193*; 8 Oct 1960, *Hevly s.n.*; On *Suaeda moquinii* in *Suaeda* flats, 17 May 1982, *Nabhan s.n.*; Several large colonies on *Suaeda moquinii*, 19 Jun 1989, *Felger 89-241* (ARIZ, ASU).

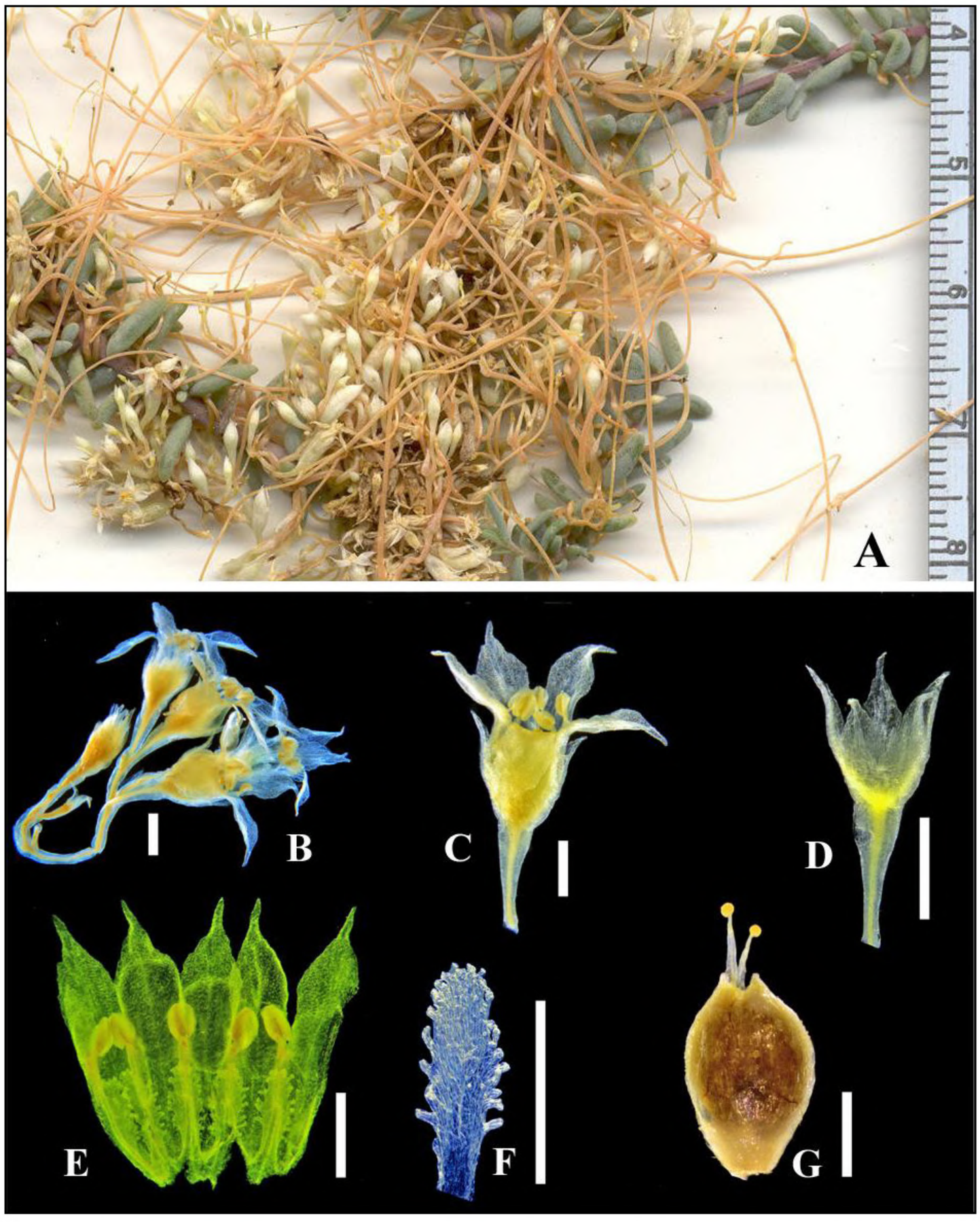

Figure 4. *Cuscuta salina*. (A) On *Suaeda nigra*, Quitobaquito, 11 Sep 2008. Flower morphology, scale bars = 1 mm: (B) fragment of inflorescence; (C) flower; (D) calyx, not dissected; (E) dissected corolla; (F) infrastaminal scale removed from the flower; (G) gynoecium.

Cuscuta tuberculata Brandegee
Desert dodder. Figure 5.

Inflorescences loose, umbelliform or racemiform; pedicels 2–3 (5) mm long. Flowers 5-merous, 2.5–4 mm long, membranous; papillae present especially at the base of the corolla tube. Calyx 0.5–1.5 mm long, yellow, finely reticulate or not, ± glossy, campanulate-angular, ⅓–½ as long as the corolla tube, the calyx tube 0.2–0.5 mm long, the lobes 1–1.3 mm long, not basally overlapping, triangular to lanceolate, carinate and with multicellular protuberances, acute to acuminate. Corollas 2–3.5 mm long, the tube 1.5–2.2 mm long and cylindrical, the lobes 1.2–2 mm long, ½ the length of the corolla tube, bridged at 0.3–0.5 mm, ovate, uniformly short-fringed, fimbriae 0.05–0.15 mm long. Ovary globose; styles 1.5–3 mm long, longer than the ovary, and evenly filiform. Capsules 1.3–2.2 × 1–2.3 mm, circumscissile, globose, slightly thickened and risen around the small interstylar aperture, translucent, capped by the withered corolla. Seeds usually 4 per capsule. Facultative xenogamous (Wright et al. 2012). Reference: Costea & Stefanović (2010).

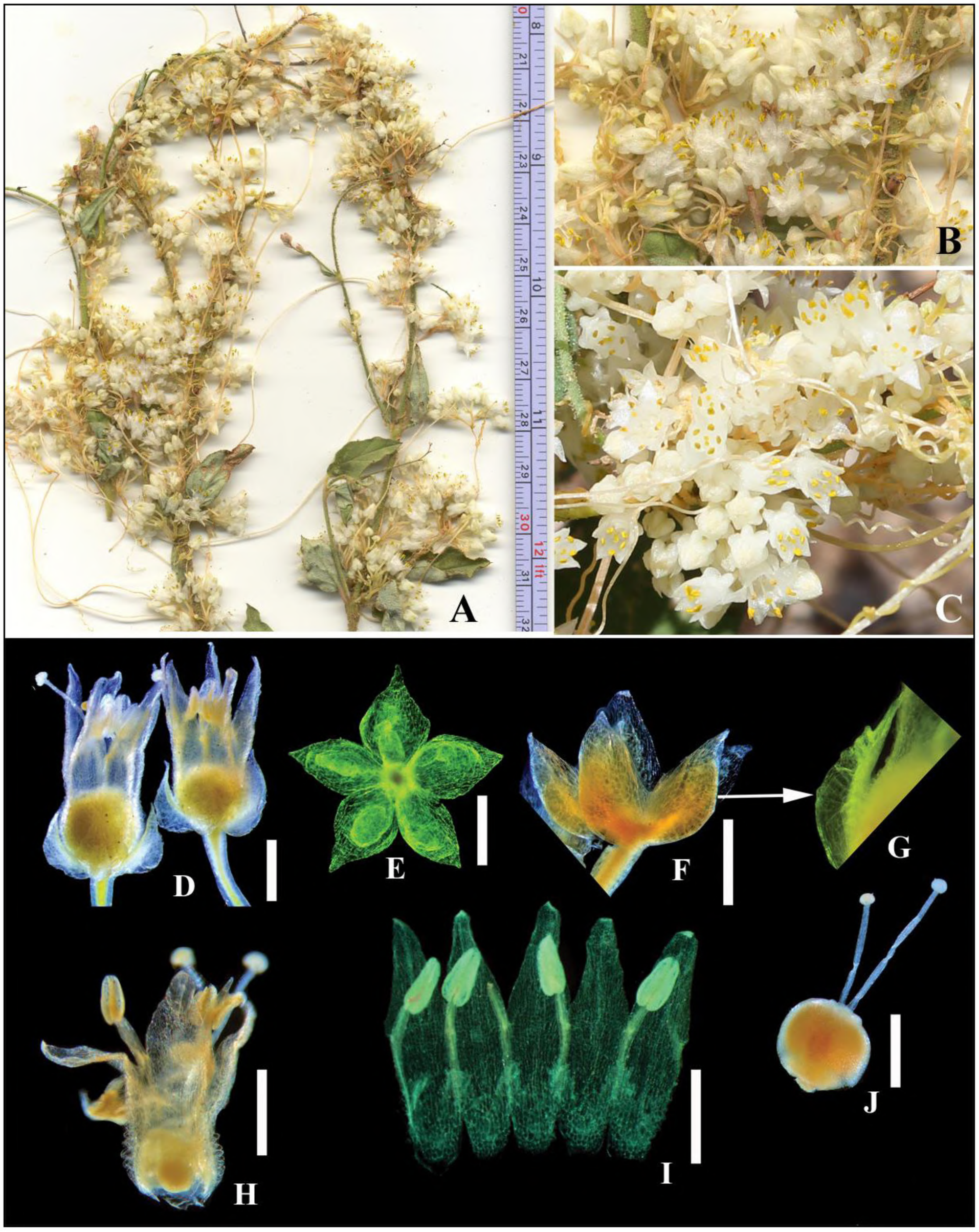

Figure 5. Cuscuta tuberculata. (A & B) On Boerhavia, Alamo Canyon, 7 Sep 2013. (C) Gunsight Hills near E boundary of Organ Pipe, 10 Sep 2013. Flower morphology, scale bars = 1 mm: (D) flowers; (E) dissected calyx; (F) calyx, not dissected; (G) detail of calyx lobe carena (carinate keel); (H) corolla (note the papillae on the corolla tube); (I) dissected corolla; (J) gynoecium.

Widespread in lowland desert areas and extending into mountains in Organ Pipe; on summer ephemerals, especially *Boerhavia* spp. and *Pectis papposa*.

Southwest and south-central Arizona, New Mexico, northern Mexico including Baja California Sur and western Sonora southward at least to the vicinity of Hermosillo.

OP: 16.3 mi by road N of Lukeville, disturbed area, low rocky hills, mostly on *Boerhavia coulteri*, 26 Sep 1964, *Felger 10532*. Bull Pasture, on *Boerhavia*, 5 Nov 1977, *Bowers 949*. N end Cipriano Hills, on *Boerhavia*, 18 Sep 1988, *Wirt s.n.* Basalt flat near W-facing slopes of Santa Rosa Mts, on *Boerhavia spicata*, 29 Aug 2001, *Rutman s.n.*

Cuscuta umbellata Kunth var. **umbellata**
Figure 6.

Inflorescences dense to loose, umbelliform; pedicels 2–10 mm long. Flowers 5-merous, 2–3 mm long, membranous; papillae sometimes present but only on the adaxial face of corolla lobes. Calyx 0.8–1.4 mm long, straw-yellow, finely reticulate, slightly shiny, campanulate, equaling the corolla tube, the tube 0.25–0.6 mm long, the lobes 0.5–0.9 mm long, not basally overlapping, broadly triangular-ovate, not carinate, the margins entire, the apex obtuse to acute. Corollas 2–2.5 mm long, the tube 0.6–1.2 mm long, campanulate, the lobes 0.8–1.5 mm long, initially erect, later reflexed, equaling or slightly longer than the tube, oblong to lanceolate, the apex obtuse to acute. Infrastaminal scales 0.8–1.2 mm long, equaling or slightly longer than the corolla tube, bridged at 0.1 mm, subspathulate to obovate, uniformly dense-fringed, the fimbriae 0.15–0.32 mm long. Ovary globose; styles 0.8–1.7 mm, equaling or longer than the ovary, evenly filiform. Capsules circumscissile, 1–2.5 × 0.5–1.2 mm, depressed, irregularly thickened and slightly risen around the inconspicuous interstylar aperture, translucent, surrounded or capped by the withered corolla. Seeds 4 per capsule. Facultative xenogamous to facultative autogamous (Wright et al. 2011). Reference: Costea & Stefanović (2010).

Lowlands scattered across the flora area, especially areas of dense growth of ephemerals such as washes, floodplains, and sand flats. Parasitic on a wide range of small perennial herbs and spring and summer ephemerals including *Allionia, Boerhavia, Bouteloua, Bromus, Daucus, Euphorbia* (*Chamaesyce*), *Kallstroemia, Dinebra* (*Leptochloa panicea*), *Pectis*, *Plantago*, *Senecio, Silene, Tidestromia*, and *Trianthema*.

Arizona, Colorado, New Mexico, and Texas to South America and the West Indies.

OP: Alamo Canyon, on *Boerhavia*, 28 Aug 1943, *Clark 10924* (ORPI). Armenta Well, on *Allionia*, 1600 ft, 16 Nov 1974, *Warren s.n.* (ORPI). Aguajita, on *Bouteloua barbata, Leptochloa panicea, Trianthema portulacastrum, Tidestromia lanuginosa*, 14 Sep 1988, *Felger 88-414*. Just N of U.S./Mexico boundary E of Lukeville, 3 mi E of Dos Lomitas, on *Tidestromia*, 29 Aug 2001, *Rutman s.n.*. Growler Wash floodplain near Bates Well Ranch, 23 Aug 2001, *Rutman s.n.*. W braid of Cuerda de Leña, on *Allionia incarnata*, *7 Oct 2006, Rutman 20061007-8*.

CP: 5 km N of Pinta Sands, [on *Pectis papposa*], 2 Oct 1964, *Simmons s.n.* 1.1 mi S of Bates Well Road on road to Jose Juan Tank, at E Refuge boundary, on *Kallstroemia, Boerhavia, Allionia*, 14 Sep 1992, *Felger 92-707*. Daniel's Arroyo, on *Allionia*, 27 Sep 1992, *Harlan 329*. San Cristobal Wash, on *E. polycarpa, E. albomarginata*, 14 Sep 1992, *Felger 92-687B*. 1 mi S of Bates Well Road on road to Jose Juan Tank, at E Refuge boundary, on *Allionia, Boerhavia erecta, B. spicata, Bouteloua aristidoides*, *Kallstroemia californica, K. grandiflora, Tidestromia lanuginosa,* 15 Sep 1992, *Felger 92-740*.

Evolvulus

Annuals or perennials, stems not twining. Styles 2, bifid, the 4 stigmas long and thread-like. Native to the New World; about 100 species. Four species occur in Arizona (Austin 1988) and 7 species occur in Sonora (Felger & Austin et al. 2012).

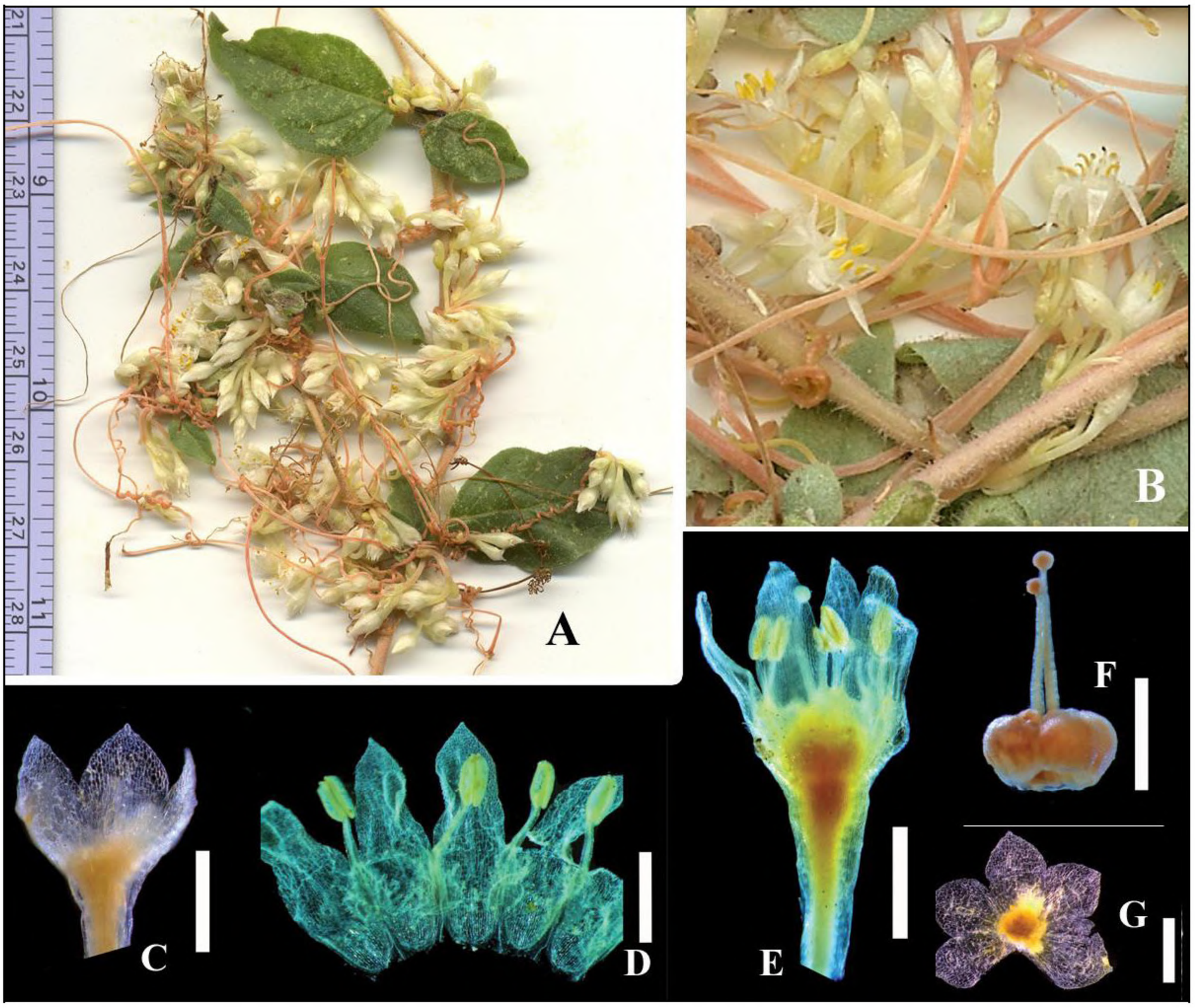

Figure 6. *Cuscuta umbellata* var. *umbellata*. (A) On *Boerhavia*, San Cristobal Wash near Camino del Diablo, 26 Sep 2013. (B) On *Boerhavia*, near Cuerda de Leña and N boundary of Organ Pipe, 30 Sep 2006. Flower morphology scale bars = 1 mm: (C) calyx (not dissected); (D) dissected corolla; (E) flower; (F) gynoecium; (G) dissected calyx.

Evolvulus alsinoides Linnaeus

[*E. alsinoides* var. *acapulcensis* (Willdenow) van Ooststroom. *E. alsinoides* var. *angustifolia* Torrey] Mouse ears; *oreja de ratón*. Figure 7.

Small tufted perennials, the herbage densely pubescent with appressed and long spreading hairs. Stems very slender and wiry, usually less than 25 cm long, dying back to near ground level in drought. Leaves 7–23 mm long, lance-linear to elliptic, smaller above, sessile or very short petioled. Pedicels slender, 3–6 mm long; calyx 2–2.5 mm long. Corollas 8–10 mm wide, rotate, pale blue with a white center, glabrate except the prominent star-like interplicae. Ovary, style, and anthers pure white, the filaments pale blue. Flowering at various seasons; flowers diurnal—opening in mid-morning and closing in the afternoon. Capsules globose, 2.5–3 mm diameter, 1–4-seeded. Flowering in warmer months with sufficient moisture.

Widely scattered in Organ Pipe in washes, canyons, and on rocky slopes.

Figure 7. *Evolvulus alsinoides*. (A) Estes Canyon, 21 Sep 2008. (B) Salero Ranch, 8 mi ESE of Tubac, Santa Cruz Co., 19 Feb 2014, photo by Sue Carnahan. (C) Alamo Canyon, 9 Sep 2013. (D) Owl Canyon, Florida Mts, Luna Co., NM, 25 Aug 2008, photo by Patrick Alexander.

Native from Arizona to South America, and now a pantropical weed. This species is extremely polymorphic. Van Ooststroom (1934) recognized fifteen varieties around the world, although the variation is often not well defined. Sonora, Arizona, New Mexico, and Texas plants belong to var. *angustifolia* Torrey. This variety typically has shorter sepals, narrower leaves, and less densely pubescent stems, and tends to have shorter stems than other varieties, if indeed the variety is worthy of recognition. At least a few populations in Asia and Australia appear to have differentiated

since post-Columbian times into potentially new infraspecific taxa, in a manner akin to the English sparrow in North America.

OP: Alamo Canyon, *Nichol 26 Mar 1938*. Sonoyta Hills, 27 Aug 1943, *Clark 10885* (ORPI). 2 mi due W of Sweetwater Pass and 0.5 mi SE of Interpretive Marker 18, 31°59'20"N, 112°4'55"W, 630 m, E-facing hillside, to 20 cm tall, growing from the bases of shrubs and through them, local but abundant, flowers lavender-blue, *Ambrosia deltoidea, Cereus giganteus, Calliandra, Coursetia, Simmondsia, Bursera microphylla, Opuntia acanthocarpa*, 1 Mar 1989, *Baker 7710* (ASU). Bull Pasture, 9 Apr 2003, *Felger* (observation).

Ipomoea – Morning Glory; *trompillo*

The three morning glories in the flora area are ephemeral vines growing with hot-weather rains. Leaf characters in the key refer to the upper or mid-stem leaves. Fruit a several-seeded capsule.

Worldwide, most diverse in tropical and subtropical regions; perhaps 600 species. Arizona has 13 species (Austin 1998) and Sonora has 41 species (Felger & Austin et al. 2012).

1. Leaves pedately dissected into 5–9 linear or linear-lanceolate segments …..... **Ipomoea costellata**
1. Leaves entire or shallowly to deeply 3–5 lobed, the lobes broad (not linear or linear-lanceolate) and not pedately arranged.

2. Corollas red-orange; sepals glabrous …….. **Ipomoea cristulata**
2. Corollas blue; sepals with coarse hairs.

3. Lower leaf surfaces usually with glandular dots; sepals 10–12 mm long; sepal bases and pedicels glabrous …….. **Ipomoea barbatisepala**
3. Lower leaf surfaces without glandular dots; sepals 12–24 mm long; sepal bases and pedicels pubescent …… **Ipomoea hederacea**

Ipomoea barbatisepala A. Gray
Figure 8.

Vines, the stems low-climbing, glabrous. Leaves glabrous, often with glandular dots at least on the lower surfaces, deeply 5–7 lobed, the lobes lanceolate and narrowed toward base, acute to acuminate. Sepals 10–12 mm long, 1–2 mm wide, the bases slightly dilated, hispid-pilose throughout, the apex elongate narrowly linear, typically erect to spreading. Corollas 1.6–2 (2.5) cm long, blue-purple with a white throat. Capsules glabrous.

In the flora area known from ephemeral watercourses in Bull Pasture and probably along other drainages in the higher elevations of the Ajo Mountains. The nearest known population is in the Baboquivari Mountains; it extends into the margins of the Sonoran Desert but not into the drier, lower desert elevations.

Arizona, New Mexico, Texas; Baja California Sur, Sonora, Sinaloa, and disjunct to Oaxaca.

In many ways this species resembles *Ipomoea hederacea*, which may grow with it, but *I. barbatisepala* is more delicate, the leaf lobes are narrower, acuminate, and deeply cut, and the corollas are typically smaller. The hirsute pubescence going the length of the sepals and the deeply lobed leaves are diagnostic.

OP: Bull Pasture, 19 Sep 2014, *Rutman 20140919-7.*

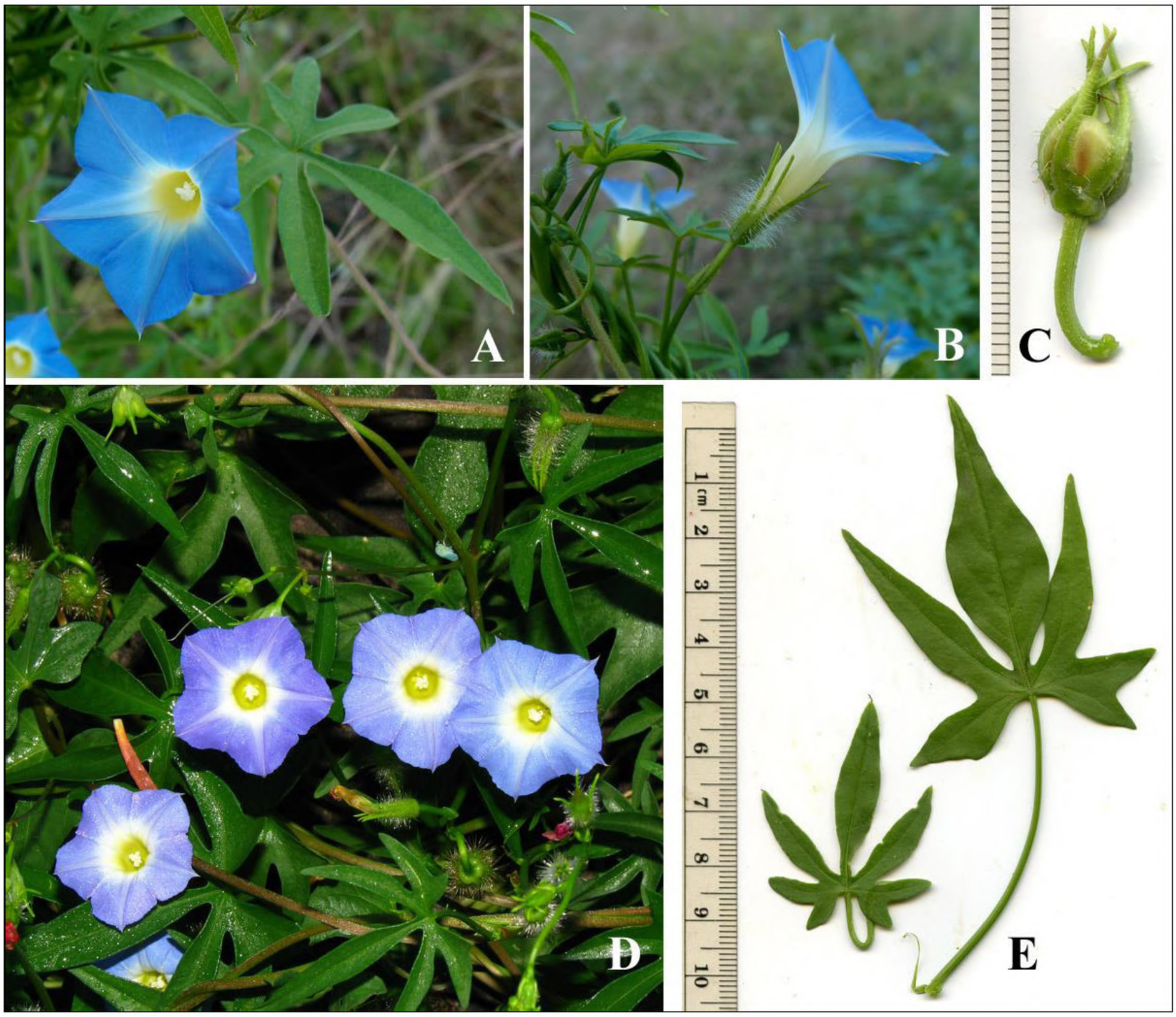

Figure 8. *Ipomoea barbatisepala*. (A & B) Salero Ranch, Santa Cruz Co., 28 Aug 2013, photos by Sue Carnahan (SEINet). (C & E) Bull Pasture stream, 19 Sep 2014. (D) Brown Canyon, Baboquivari Mts, 5 Sep 2009, photo by Dan Austin.

Ipomoea costellata Torrey

Crest-rib morning glory. Figure 9.

Stems trailing or twining. Leaves pedately dissected into 5–9 linear or linear-lanceolate segments. Sepals conspicuously crested and warty. Corollas 10–12 mm long, 5–10 (14) mm wide, pale lavender to pink.

In the flora area known only from the Ajo Mountains; it is common in Bull Pasture.

Eastward in Arizona to west Texas, most of Mexico including Baja California Sur, and Guatemala.

OP: Bull Pasture, 12 Aug 1990, *Wirt s.n.* (ORPI). Saddle between Arch Canyon and Boulder canyons, 26 Oct 2003, *Rutman 20031026-17* (ORPI). Bull Pasture area, 3170 ft, temporally wet or moist drainage on bedrock, cryptic annual growing amid dense summer growth [including] *Evolvulus*, *Ipomoea hederacea*, *I. cristulata*, etc., 25 Sep 2013, *Rutman 20130925-5*.

Figure 9. *Ipomoea costellata.* Bull Pasture, seasonally wet stream below the spring, 25 Sep 2013.

Ipomoea cristulata Hallier f.
[*I. coccinea* of authors, not Linnaeus. *Quamoclit gracilis* Hallier f.]
Scarlet morning glory. Figure 10.

Delicate to moderately robust but small vines. Leaves variable, with a cordate base, otherwise entire or shallowly to broadly 3 (5) lobed. Calyx glabrous, the lobes linear-subulate. Corollas 1–1.5 cm wide, trumpet-shaped (salviform), bright red-orange. Flowers diurnal and pollinated by butterflies and hummingbirds, however, apparently also capable of selfing (facultatively autogamous).

In the flora area known from the Ajo and Diablo Mountains.

Midwestern United States (where presumably cultivated) to Arizona and Texas, and Mexico south to Veracruz and in Baja California Sur.

OP: Alamo Canyon, 13 Dec 1939, *Harbison 26244* (SD). Arch Canyon, *Wirt 13 Oct 1990.* S fork of Alamo Canyon, 2400 ft, abundant in wash bed and xeroriparian area, 7 Sep 2013, *Rutman 20130907-1*. Diablo Mts, 2647 ft, shaded base of N-facing cliff, 22 Sep 2013, *Rutman 20130922-13*.

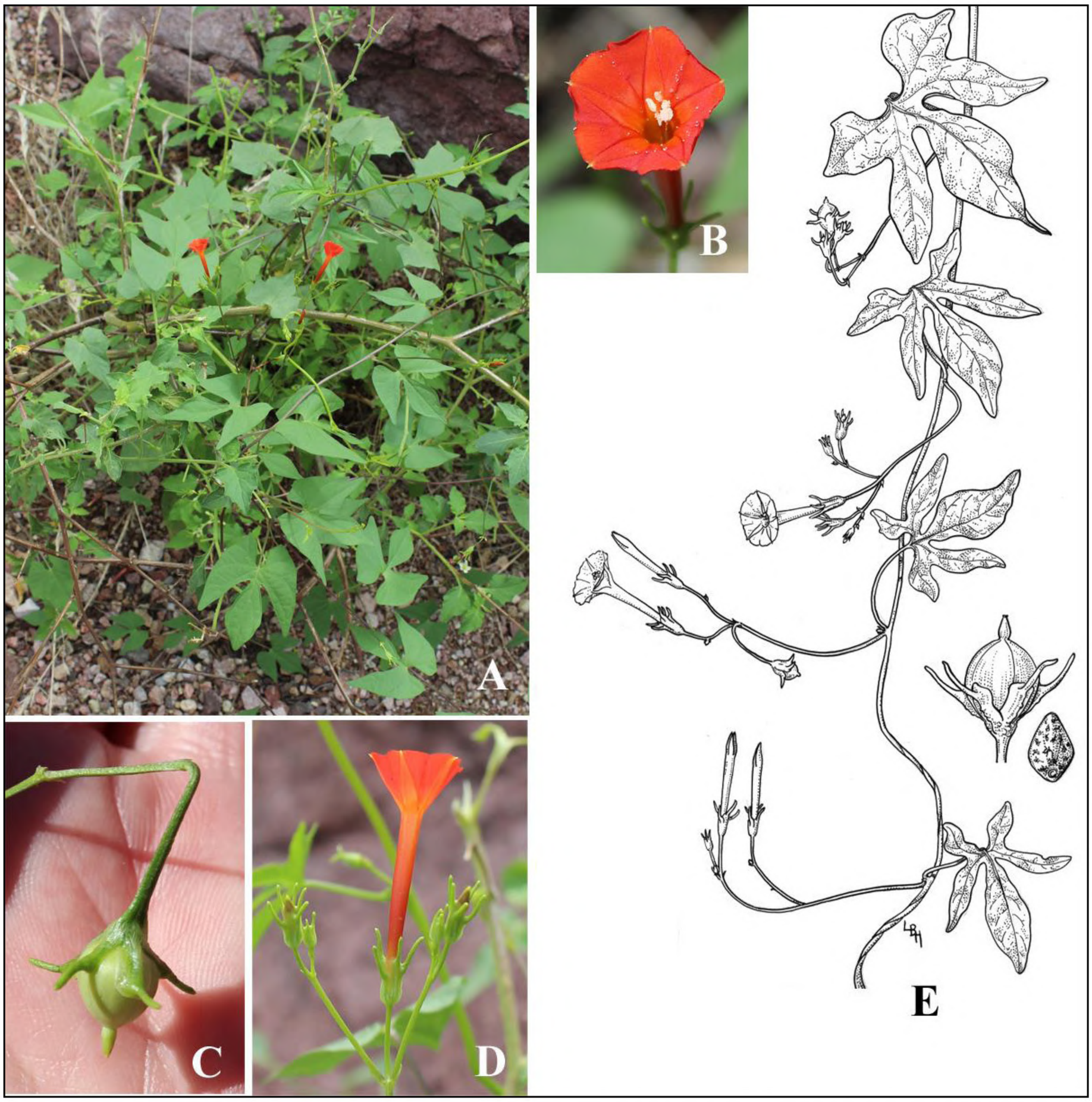

Figure 10. *Ipomoea cristulata*. Alamo Canyon: (A & D) 7 Sep 2013; (B) 9 Sep 2013; (C) 17 Oct 2013. (E) By Lucretia Brezeale Hamilton.

Ipomoea hederacea Jacquin
Ivy-leaf morning glory. Figure 11.

Vines; often robust and covering shrubs and small trees, often twining 2–3+ m in mesquites; densely to sparsely hairy throughout. Leaf blades (2) 3.5–13 (15.5) cm long and about as wide, 3-lobed to 3- or 5-parted. Calyces 15–25 mm long, the lobes lanceolate, narrowed above the base, the expanded, basal portion with long spreading hairs. Corollas opening wide, often 3–3.5 cm wide, light blue with a white base, open in the early morning and visited by white-lined sphinx moths (*Hyles lineata*) and butterflies, and closing with mid-morning heat. Capsules 9 mm wide. Seeds 4.5–4.8 mm long, dark brown to blackish, wedge-shaped, with minute hairs.

Often locally abundant following summer rains, growing through mesquites and other shrubs along large washes and canyon bottoms. Ajo Mountains and the northern part of Organ Pipe, and

especially the larger, brushy washes such as the San Cristobal and Growler Wash systems in the eastern part of Cabeza Prieta where it often festoons mesquites in green curtains (Felger 2007).

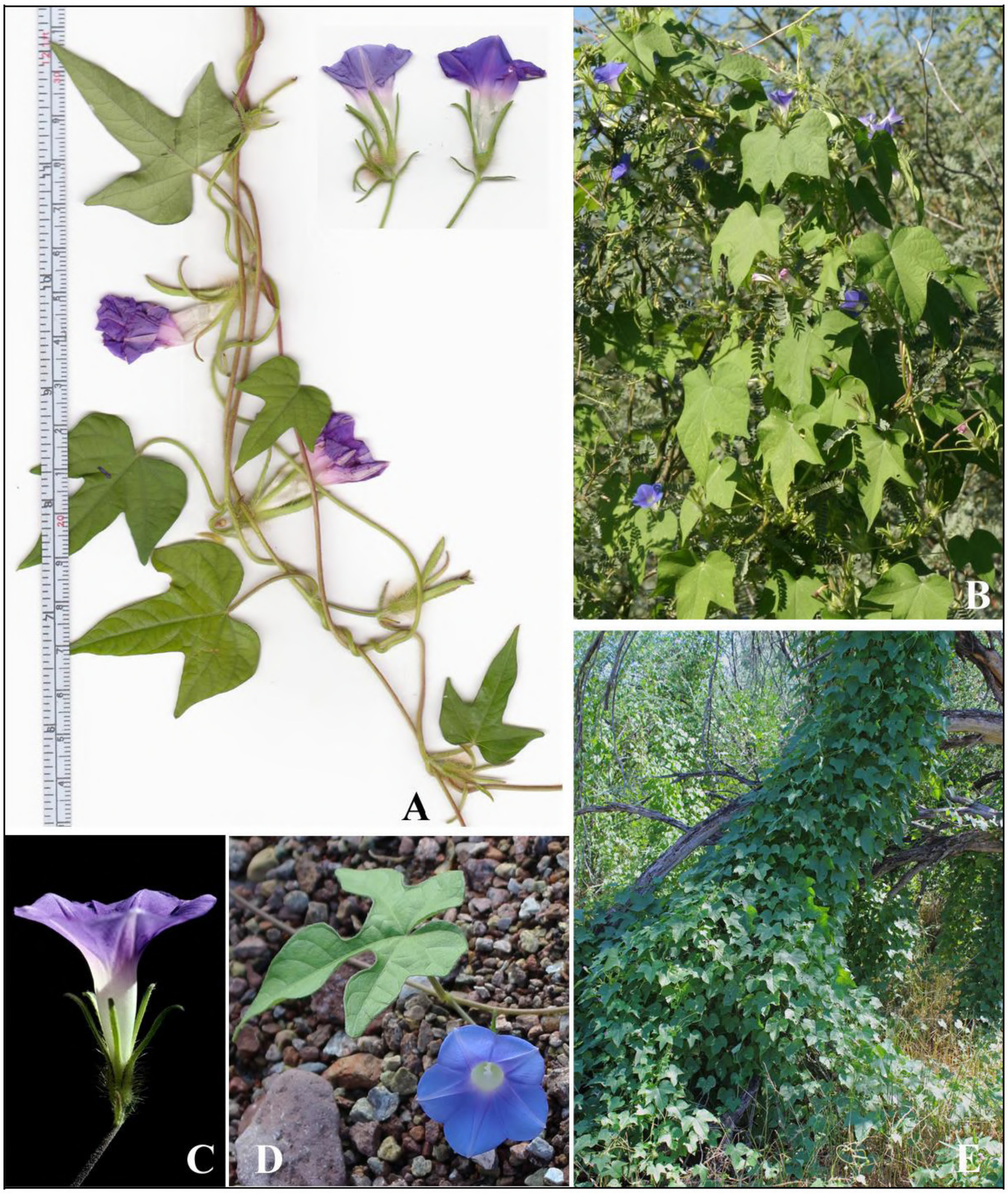

Figure 11. *Ipomoea hederacea*. (A) Armenta Ranch, 12 Sep 2008. Alamo Canyon: (B) 7 Sep 2013; (D) 9 Sep 2013. (C) Catalina Mts, Pima Co, Sep 1989, photo by Dan Austin. (E) Climbing on *Prosopis velutina*, wildlife tank near N boundary of Organ Pipe, E of Hwy 85, 20 Sep 2013.

Temperate North and South America; introduced in the Old World and also likely introduced into South America.

OP: Alamo Canyon, 28 Aug 1943, *Clark 10939* (ORPI). Bull Pasture Trail, 11 Sep 1988, *Wilson 189*. Road to Armenta Ranch, 1 Feb 2002, *Felger* (observation, dry, dead plants).

CP: Monreal Well, *Monson 19 Sep 1959*. San Cristobal Wash: 14 Sep 1992, *Felger 92-693*.

†**Ipomoea** sp.

OP: †Alamo Canyon, fruit, 1150 ybp.

Jacquemontia

Perennials or occasionally annuals; 80–100 species in the Americas and several in Australia. Four species in Arizona (Austin 1988) and five in Sonora (Felger & Austin et al. 2012).

Jacquemontia pringlei A. Gray

Desert cluster-vine. Figure 12.

Perennials; scandent or sprawling subshrubs, with 4–6 rayed stellate hairs, the upper stems often twining, growing and flowering during the warmer months. Leaves 2–6 cm long, petioled, the blades ovate with entire margins. Inflorescences of axillary cymes with 1–7 flowers. Outer sepals broadly ovate, the inner sepals narrower. Corollas about 2 cm wide, white, becoming pale lavender as the flower ages during the day.

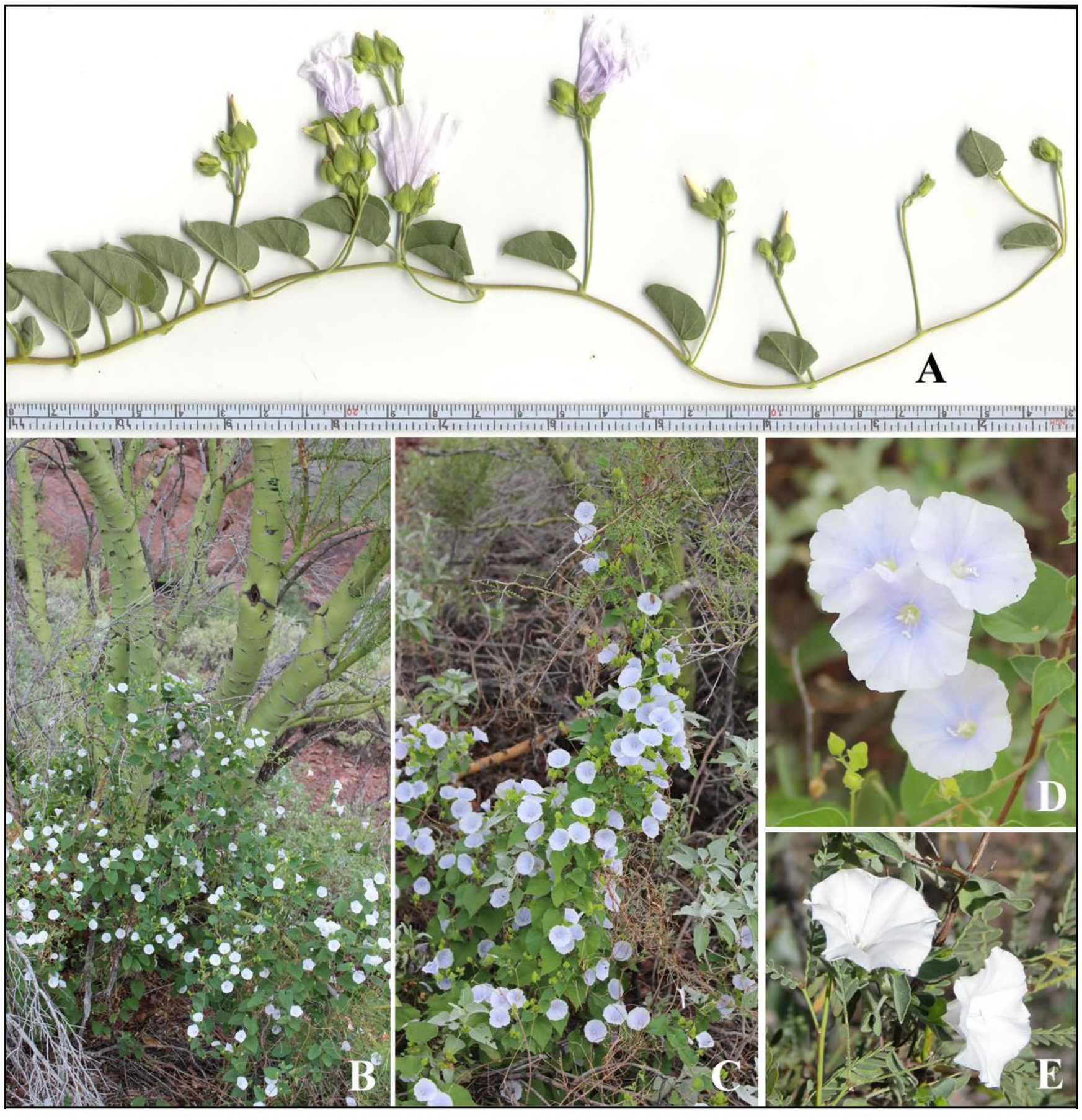

Figure 12. *Jacquemontia pringlei*. Alamo Canyon, south-facing slope: (A & E) 10 Sep 2008; (B) 7 Sep 2008; (C & D) 7 Sep 2013.

In the flora area known from the Ajo Mountains, at least in Alamo Canyon. This is the most arid and farthest western locality verified for the genus.

This species ranges from southern Arizona to northwestern Sinaloa and southwestern Chihuahua; it is widespread through Sonora except the northwestern corner of the state. This genus has its greatest diversity in tropical and subtropical Latin America. An enigmatic specimen collected by A.A. Nichol on 25 April 1938 at the "South end of Gila Mountains" seems out of place and the locality questionable. Before the mid-20th century it was customary to include the Tinajas Altas Mountains in the concept of the Gila Mountains. On that same day Nichol collected *Muhlenbergia dumosa* in the "Mohawk Mountains" and *Aristida purpurea* in the "Gila Mountains" (specimens at ARIZ). There are no other records for *Jacquemontia* or *Muhlenbergia dumosa* in Yuma County (Felger & Van Devender et al. 2012; SEINet 2014). Richard has looked for them in possible habitats in the Gila-Tinajas Altas Mountains.

OP: Ajo Mts, 21 Nov 1934, *Goodding 227*. Alamo Canyon: 28 Aug 1943, *Clark 10945* (ORPI); *Van Devender 31 Aug 1978* (ORPI). Ajo Mts, mouth of Alamo Canyon, 2200 ft, 7 Sep 1947, *Fouts 198* (NMC).

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